REMARKS

By this amendment the specification and claims 20 and 24 have been canceled and claims 1, 19, 23, 25, and 26 have been amended. Claims 1-19, 21-23, 25, and 26 are pending. Reconsideration of the application as amended is respectfully requested.

A marked-up version of the specification and claims is submitted as Appendix I to show the changes made.

Rejections Under 35 USC §112

Claims 19-22 have been rejected under 35 USC §112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner states that "[t]he wording used in claim 19 is confusing, and should be rewritten." The Examiner does not discuss what language is confusing.

The amendments to claim 19 are believed to overcome the Examiner's rejection. However, if this rejection is maintained in a subsequent office action, a more detailed explanation of the point of confusion is respectfully requested so the applicant has fair opportunity to reply.

Rejections Under 35 USC §103

Claims 1-11, 19, and 22 have been rejected under 35 USC §103(a) as being unpatentable over Amini et al. (US 5,030,590). Amini proposes a three step process comprising two dry etches and a wet etch. In a first RIE etch Amini uses Cl_2 at 30 sccm and HBr at a flow rate of 15 sccm. Amini further uses a power (i.e. a top plate power) of 250 watts. Amini does not specify the use of a bottom plate (and therefore does not specify a bottom plate power) nor is a pressure range specified. This etch removes polysilicon. In a second RIE etch Amini uses HBr at a flow rate of 30 sccm, Cl_2 at a flow rate of 15 sccm, and a mix of 70% He and 30% O_2 at a flow rate of 2 sccm. This etch removes polysilicon without etching silicon oxide. The third etch uses potassium hydroxide to remove polymerized silicon and oxide-containing materials. See column 4.

Rejected claims 1-11 recite etch parameters neither taught nor suggested by Amini. For example, claim 1 recites an etch comprising a pressure of from about 42 mTorr to about 78 mTorr, a lower power of from about 49 watts to about 91 watts, and a halogen-containing gas flow rate of from about 35 sccm to about 65 sccm. Thus Amini does not teach or suggest the use of a bottom plate, the bottom power range specified by present claim 1, the pressure range specified by claim 1, nor the halogen-containing gas flow rate specified.

As stated by MPEP §706.02(j), "the prior art reference (or references when combined) must teach or suggest all the claim limitations" to establish a *prima facie* case of obviousness. As every feature is not recited by Amini as applied by the Examiner, instant claim 1 is allowable over Amini. The Examiner takes official notice that a parallel plate reactor is well-known in the art. Even with this consideration, one in the art would have to achieve the bottom plate power settings specified in the instant claims and also the pressure settings specified. This is believed to be beyond the scope of Amini in combination with parallel plate reactors using routine experimentation to achieve the results discussed in the instant specification, and are possible only using the instant claims as a blueprint which is not permitted (*Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 227 USPQ 543, Fed. Cir. 1985).

The Examiner further cites *In re Aller*, 220 F. 2d 454, 105 USPQ 233, 235 (CCPA), and states that where "the general conditions of a claim are disclosed in the prior art it is not inventive to discover the optimum or workable ranges by routine experimentation." It is submitted that the facts of *In re Aller* are different than those of the instant case. For example, *In re Aller* states that "[t]he process of appellants is identical with that of the prior art, except that appellants' claims specify lower temperatures and higher sulphuric acid concentrations than are shown in the reference." With the instant case, the process of the present invention as claimed is not identical to the disclosure of Amini, at least because the instant rejected claims recite the use of bottom power, the range of the bottom power, and a pressure range, none of which are recited by Amini. Thus the parameter settings of the present application are not merely different from Amini, but Amini fails to disclose the parameters themselves. Further, *In re Aller* appears to at least hint that if Aller comprised a parameter not disclosed by the cited art patentability would at least be considered (see the penultimate paragraph of *In re Aller*, for example). Thus it is submitted that the Examiner's citation of *In re Aller* is moot as the facts of the case are clearly different and thus not applicable to the present matter.

Claims 19 and 22 have been rejected over Amini. Claim 20, which was not rejected over Amini, has been written into claim 19 and canceled. Thus claim 19 and claim 22 which depends from claim 19 are allowable over Amini, and the rejected claims 1-11, 19, and 22 are allowable over Amini et al.

Claims 1-11, 19, and 22-26 have been rejected under 35 USC §103 over Shwartzman et al. (US 4,818,334). Shwartzman discusses placing a semiconductor device between two electrodes of a standard plasma etching apparatus (col 3 lines 5-9). A first etch step includes providing chlorine at a flow rate of 20 sccm, nitrogen at a flow rate of 10 sccm, and 10 sccm of chloroform at a pressure of about 125 mTorr. Shwartzman further discusses connecting two electrodes across a source of electrical current at a power of about 500 watts (col 3 lines 5-20). A second etch step includes a pressure of about 100 mTorr, flowing 15 sccm helium, 40 sccm chlorine, and 10 sccm CO_2 and connecting the two electrodes across a source of current at a power of 225 watts (col 3 lines 46-57).

With regard to rejected claims 1-11 and 23, 25, and 26, Shwartzman fails to recite claimed parameters of the instant invention, for example a reactor upper power and a reactor lower power. As independent claims 1 and 23 recite an upper power range and a lower power range, and Shwartzman does not appear to recite either of these parameters, claim 1 and claims 2-11, 25, and 26 which depend therefrom are allowable for this reason alone. Further, claims 1-4, 6-8, 11, 23, and 25 each recite parameter ranges not taught by Shwartzman, and claim 10 recites an oxygen-containing gas which is not taught by Shwartzman, and thus these claims are separately allowable over Shwartzman. Claim 26 recites etching the stringers with an etch consisting essentially of a halogen-containing gas and an oxygen-containing gas, while Shwartzman requires the use of helium or another inert material (col 3 lines 52-55), and thus claim 26 is further allowable over Shwartzman.

Claim 20, which was not rejected by the Examiner over Shwartzman, has been written into independent claim 19. Thus claims 19 and 22 are allowable over Shwartzman.

The Examiner has again cited *In re Aller*. As the instant claims rejected over Shwartzman comprise parameters not discussed by Shwartzman, the facts of *In re Aller* are clearly different from the present case and is thus not applicable as with the rejection over Amini et al.

Claims 1-26 have been rejected under 35 USC §103(a) as being unpatentable over Rizzuto (US 6,001,688). Rizzuto recites etching of a polysilicon layer using either HBr and O_2 or HBr, O_2, and Cl_2 which results in the formation of undesirable poly stringers (col. 6 lines 62-66). After this initial step, a cleanup etch is performed using SF_6 and CF_4, either alone or with the addition of O_2 or HBr (col 7 lines 12-18). Rizzuto recites that "other etch parameters may also be controlled such as ...flow rates...chamber pressure...plasma excitation power...substrate bias voltage, etc." (col. 7 lines 27-30). Rizzuto fails to disclose any ranges for various parameters such as gas flow rates, chamber pressure, upper plate power values, and lower plate power values. The Examiner indicates that these parameters can be determined by one skilled in the art.

The rejection of the instant claims over Rizzuto as applied by the Examiner is respectfully traversed. Using the Examiner's reasoning, it appears that every possible etch in a parallel plate reactor would be unpatentable over Rizzuto. In reality, the settings required to etch a material are known to be interactive with other parameters, and not at all obvious over a reference which fails to disclose any ranges for various parameters such as gas flow rates, chamber pressure, upper power values, and lower power values. The disclosure of Rizzuto is merely an invitation to experiment with no direction being given regarding the environmental conditions of the etch. It is simply not reasonable to expect that a reading of Rizzuto, which omits suggestions of specific environmental conditions during the etch, could result in the conditions instantly claimed.

The present specification teaches that "a lower pressure will provide a more vertical anisotropic etch...and a higher pressure will provide a more isotropic etch." Further, "as the top power increases the etch will become more isotropic and as bottom power increases the etch will become more anisotropic" (page 5 lines 4-8). Also recited is the "amount of polysilicon etched toward the bottom of the opening varies proportionally with the amount (flow rate) of oxygen-containing gas" (page 5 lines 22-23) and that "especially high proportions of oxygen-containing gas, especially in combination with top power in the higher range, may result in the structure of FIG. 4 wherein the polysilicon feature 26 being etched is undercut" (page 6 lines 5-8). Thus the ranges specified in the claims and their mutual interactions impart criticality to the invention and are inventive over Rizzuto, which does not specify various environmental conditions such as those described in the previous paragraph.

The Examiner again cites *In re Aller*, and it is again submitted that *In re Aller* does not apply to the instant rejection. As recited by the Examiner, "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." However, Rizzuto does not indicate the general condition of the invention as presently claimed, but merely states that "other etch parameters may also be controlled such as...flow rates...chamber pressure...plasma excitation power...substrate bias voltage, etc." Thus it is submitted that the present claims are allowable over Rizzuto, at least because Rizzuto does not narrow the countless possible interactive ranges to teach or suggest the instantly-claimed etch conditions.

For the reasons stated above, remaining claims 1-19, 21-23, 25, and 26 are allowable over the cited art as applied by the Examiner.

The Examiner takes official notice on several matters which are deemed to be "conventional or at least well known in the plasma etching arts." The Applicant will not traverse the assertions at this time, as it is believed that even if each of the Examiner's assertions is correct there is insufficient teaching in the cited art to result in the present invention as claimed. However, Applicant does not concede the propriety of the Office's official notice as taken, and reserves the right to traverse same and request proof of the representations taken in the context of "official notice" asserted by the Office at a later time if the Office persists in the present rejection.

Conclusion

If the Examiner believes a conference will expedite prosecution of the application, the Examiner is cordially invited to call the undersigned at the number indicated. This is believed to be a complete and proper response to the Examiner's outstanding office action.

Respectfully Submitted,

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APPENDIX I
VERSION WITH MARKINGS TO SHOW CHANGES MADE

The paragraph on page 8 lines 9-13 has been amended as follows:

-- FIG. 6 depicts an etch using a flow rate of 9 sccm HeO_2, 50 sccm HBr, 100 sccm He, 70 watts lower power, 350 watts upper power, a pressure of 60 mTorr, and a duration of 60 seconds. The resulting etch undercuts the polysilicon 60, especially toward the bottom of the feature. The upper portion of the polysilicon 60 remains substantially vertical. This etch removes the polysilicon at a faster isotropic rate than the etch described with reference to FIG. 5. --

Claims 20 and 24 have been canceled and the following claims have been amended as indicated below.

1. (amended) A method used during the formation of a semiconductor device comprising the following steps:

forming a polysilicon layer;

etching said polysilicon layer with an etch in an environment comprising a pressure of from about 42 mTorr to about 78 mTorr, an upper power of from about 245 watts to about 455 watts, a lower power of from about 49 watts to about 91 watts, a halogen-containing gas flow rate of from about 35 sccm to about 65 sccm, and an oxygen-containing gas having an oxygen flow rate of from about 1.9 sccm to about 4.68 sccm.

19. (amended) A method used during the formation of a semiconductor device comprising the following steps:

providing a semiconductor substrate assembly having at least first and second features therein in spaced relation to each other, wherein said first and second features define an opening therebetween;

providing a blanket polysilicon layer over said semiconductor substrate assembly and within said opening;

forming a patterned photoresist layer over said blanket polysilicon layer;

etching a portion of said blanket polysilicon layer within said opening with a first etch

comprising a halogen-containing gas flow rate of from about 35 sccm to about 65 sccm, and an oxygen-containing gas having an oxygen flow rate of from about 1.9 sccm to about 2.7 sccm;

subsequent to said first etch, etching said portion of said polysilicon layer within said opening with a second etch comprising a halogen-containing gas flow rate of from about 35 sccm to about 65 sccm and an oxygen-containing gas having an oxygen flow rate of from about 3.6 sccm to about 4.7 sccm.

23. (amended) A method used during the formation of a semiconductor device comprising the following steps:

forming a polysilicon layer;

etching said polysilicon layer, wherein said etch of said polysilicon results in the formation of polysilicon stringers;

etching said polysilicon stringers with an etch comprising a halogen-containing gas having an oxygen flow rate of between about 35 sccm to about 65 sccm and an oxygen-containing gas at a flow rate of from about 1.9 sccm to about 4.7 sccm, an upper power of from about 315 watts to about 388 watts, and a lower power of from about 63 watts to about 77 watts.

25. (amended) The method of claim 23 wherein said step of etching said polysilicon stringers further comprises a pressure of from about 54 mTorr to about 66 mTorr, [an upper power of from about 315 watts to about 388 watts, a lower power of from about 63 watts to about 77 watts,] a halogen-containing gas flow rate of from about 45 sccm to about 55 sccm, and an oxygen-containing gas having an oxygen flow rate of from about 2.4 sccm to about 4.0 sccm.

26. (amended) The method of claim 23 wherein said etch [consists] of said stringers comprises etching said stringers with an etch consisting essentially of a halogen-containing gas and an oxygen-containing gas.